

# Fact Sheet

## National Institute of Biomedical Imaging and Bioengineering INTRAMURAL RESEARCH PROGRAM



### NIBIB CONTACT

Dr. Richard Leapman  
Scientific Director  
Intramural Research Program  
301-496-2599  
e-mail:  
[LeapmanR@mail.nih.gov](mailto:LeapmanR@mail.nih.gov)

[www.nibib.nih.gov](http://www.nibib.nih.gov)

Please note: The IRP portion of NIBIB's website is in the process of being updated and expanded.



## Introduction

The mission of the National Institute of Biomedical Imaging and Bioengineering (NIBIB) is to improve health by leading the development of biomedical technologies and accelerating their application. The NIBIB encourages the integration of the physical sciences and the life sciences to advance human health by improving quality of life and reducing the burden of disease.

The NIBIB's Intramural Research Program (IRP), based in Bethesda, Maryland, has expertise that spans technologies ranging in scale from near-atomic resolution to intact organisms.

## Current Research

The IRP's research often involves collaboration with other NIH institutes, other government agencies, academia and industry. Program areas include:

### • *Supramolecular Structure and Function*

**Purpose:** to determine the shape, organization and three-dimensional structure of macromolecular assemblies and the chemical composition of cellular organelles; and to relate structure to function at the subcellular and molecular level. Methods include quantitative, high-resolution electron microscopy, electron tomography, nanoscale spectroscopic imaging, and novel labeling techniques.

### • *Dynamics of Protein Assembly*

**Purpose:** to develop biophysical methods to characterize macromolecules and their reversible interactions, including elucidating the relationship between protein structure and function, and the assembly of multi-protein complexes and molecular machines. Methods include analytical ultracentrifugation, surface plasmon resonance biosensing, photon correlation spectroscopy, isothermal titration and differential scanning microcalorimetry, and circular dichroism.

### • *Complex Biological Systems*

**Purpose:** to develop novel instrumentation and mathematical models for improved understanding of complex biological systems at the nanoscale. Methods include high-resolution atomic force microscopy under physiological conditions with sensitive force measurements and mathematical modeling, optical and laser technologies, fluorescence and optical spectroscopy, and application of novel reporter molecules.

### • *Immunochemical Nanoscale Analysis and Diagnostics*

**Purpose:** to develop new technologies, including real-time, minimally invasive, microdialysis techniques and "lab on a chip" microfluidic immu-

noassays for the identification of biomolecules.

Methods include microfabrication, laser induced fluorescence detection, measurement of analytes at sub-femtogram levels, mass spectrometry, time-resolved fluorescence, chromatographic analysis of protein expression and secretion from single cells.

### • *Positron Emission Tomography (PET) Radiochemistry*

**Purpose:** to develop radiopharmaceuticals for positron emission tomography, which enable *in vivo* imaging of biochemical processes. Design of new radioligands for PET can improve understanding of disease and lead to development of new therapeutic drugs. Methods include radiolabeling, chemical synthesis, chemical analysis, and pre-clinical studies using *in vitro* and *in vivo* techniques.

### • *Pharmacokinetics and Drug Delivery*

**Purpose:** to model and improve delivery of drugs, including macromolecules, to targeted tissues in both animals and humans; and to model the anatomical distribution of endogenous metabolites and environmental contaminants. Methods include estimation of dose response, toxicity, diffusion, fluid flow, convection, and interactions with cellular receptors.

### • *Non-invasive Optical Imaging*

**Purpose:** to develop real-time, non-invasive methods for evaluating and monitoring tissues and organs, with applications to cancer diagnosis and monitoring the viability of kidneys destined for transplantation. Methods include optical subsurface imaging of fluorophores, as well as sensitive infrared imaging of thermal gradients in tissues.

## Training Opportunities

The NIBIB's IRP offers training opportunities at several educational levels, including nationwide competitions for the Biomedical Engineering Summer Internship Program (for undergraduates completing their junior year in a bioengineering program, <http://dbeps.ors.od.nih.gov/besip/index.htm>) and the NRC Research Associateship Program (a joint NIH/NIST program for postdocs, [www.training.nih.gov/postdoctoral/nist.asp](http://www.training.nih.gov/postdoctoral/nist.asp)).